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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/709,406

05/03/2004

Colin J. Brodsky

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INTERNATIONAL BUSINESS MACHINES CORPORATION

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HOPEWELL JUNCTION, NY 12533

EXAMINER

NGUYEN, THANH T

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 07/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/709,406

Applicant(s)

BRODSKY ET AL.

Examiner

Thanh T. Nguyen

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 7-12 and 14-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 13, 19 and 20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5/27/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Claims 7-12, 14-18 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected non-elected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 4/21/06.

Information Disclosure Statement

The information disclosure statement filed on 4/21/06 has been considered.

Oath/Declaration

Oath/Declaration filed on 5/3/06 has been considered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. "*New approach for Pattern collapse problem by increasing contact Area at Sub-100nm Patterning*" Proc. SPIE-The International Society for Optical Engineering, June 2003, pp. 166-174, Vol. 5039 (cited by applicant), in view of Sakamoto et al. (U.S. Patent Publication No. 2003/0015342).

Referring to figures 4, Lee et al. teaches a method of preparing a substrate for photolithographic patterning, comprising:

providing a substrate having at least an exposed rough surface layer including a polymeric material (see figure 4, the polymeric is sacrificial organic BARC), said surface layer having surface features (using etching to provide rough surface; and

depositing a layer of photoresist material over said surface layer (see figure 4, resist film).

Regarding to claim 2, wherein said layer of photoresist material is deposited onto the surface layer (see figure 4).

Regarding to claim 3, wherein said surface layer is formed by roughening an exposed surface of a polymeric material layer(roughening by etching method, see figure 4).

Regarding to claim 4, wherein said polymeric material layer is an anti-reflective coating (ARC) (see figure 4, sacrificial BARC).

Regarding to claim 5, wherein surface layer has a multiplicity of openings having a retrograde profile (etching inclined angle, see figure 4).

Regarding to claim 13, further comprising photolithographically patterning said layer of photoresist material into photoresist patterns (see figure 4).

However, the reference does not teach roughened the surface of the layer by using ion milling or plasma to remove the material, surface layer having surface features characterized by feature step height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half.

It would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to optimize the height of the surface feature, since it has been held that where the general conditions of a claim are disclosed in the prior art (i.e.- height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half), discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 (CCPA 1955).

The specification contains no disclosure of either the critical nature of the claimed arrangement (i.e.- wherein height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the applicant must show that the chosen limitations are critical. In re Woodruff, 919 F.2d 1575, 1578 (FED. Cir. 1990).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form the layer with height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half in process of Lee et al. because determining the optimum height for the layer only involved routine skill in the art.

Sakamoto et al. teaches in figure 3(D) forming a rough surface resin layer (50, polymeric) by chemical etching or by plasma process (see paragraph# 121).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would recognized that to form the rough surface layer by using plasma process in Lee et al. as taught by Sakamoto et al. because the process would is known in the art to form a layer with rough surface to increase contact surface area.

Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Qian et al. (U.S. Patent No. 6,365,968) in view of ordinary skill in the requisite art.

Referring to figures 7-10, Qian et al. teaches a method of photolithographically patterning a layer of a substrate, comprising:

providing an exposed rough surface layer over an underlying layer (114) of said substrate, said surface layer including a polymeric material (116a);

depositing a layer of photoresist material (156/157) over said exposed rough surface layer;

photolithographically patterning said photoresist material layer into photoresist patterns (see figures 9-10, col. 5, lines 37-49);

and etching a portion of said underlying layer exposed by said photoresist patterns (see figures 9-10, col. 5, lines 37-49).

However, the reference does not teach surface features characterized by feature step height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half.

It would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to optimize the height of the surface feature, since it has been held that where the general conditions of a claim are disclosed in the prior art (i.e.- height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half), discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 (CCPA 1955).

The specification contains no disclosure of either the critical nature of the claimed arrangement (i.e.- wherein height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the

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applicant must show that the chosen limitations are critical. In re Woodruff, 919 F.2d 1575, 1578 (FED. Cir. 1990).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form the layer with height varying between about two percent and twenty percent of the minimum photolithographic half-pitch, and the photolithographic half-pitch of less than about 110 nm and a height-to-width aspect ratio of greater than about two and one half in process of Lee et al. because determining the optimum height for the layer only involved routine skill in the art.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See MPEP 203.08).



Thanh Nguyen
Patent Examiner
Patent Examining Group 2800